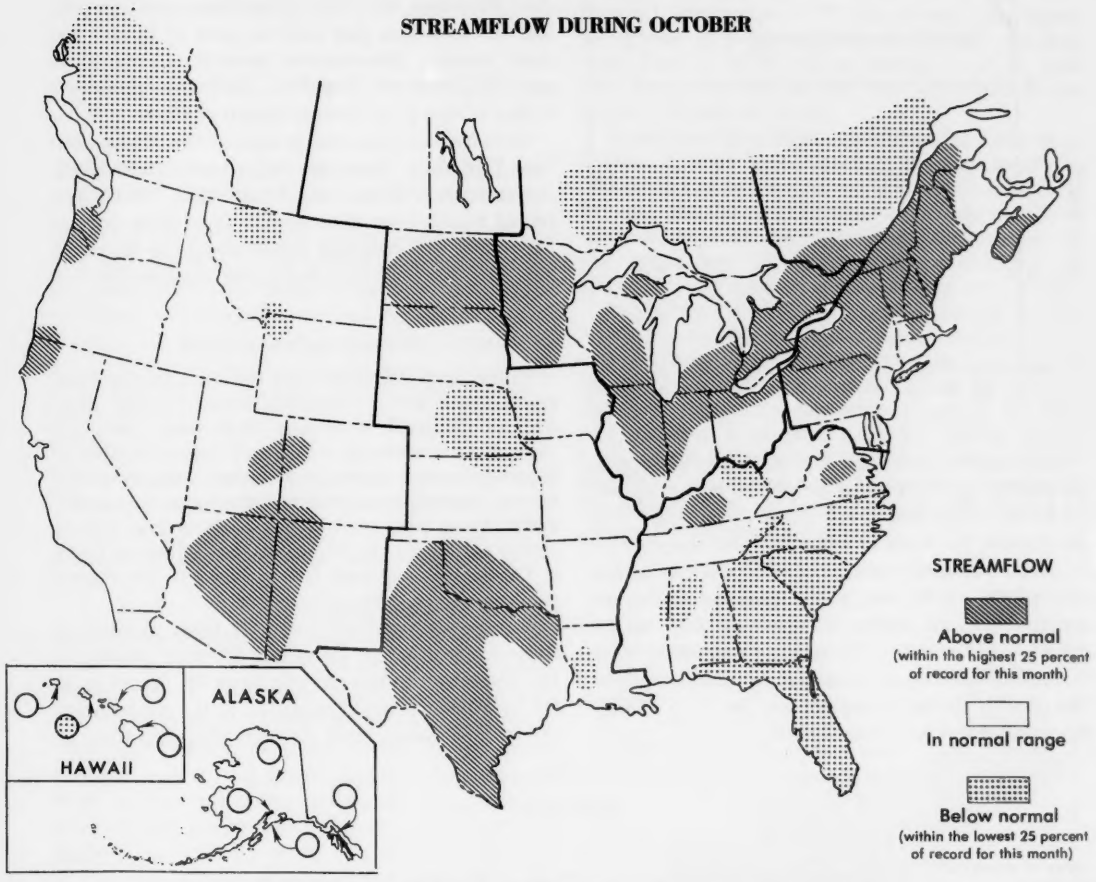
WATER RESOURCES REVIEW for OCTOBER 1981

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

STREAMFLOW DURING OCTOBER



STREAMFLOW AND GROUND-WATER CONDITIONS

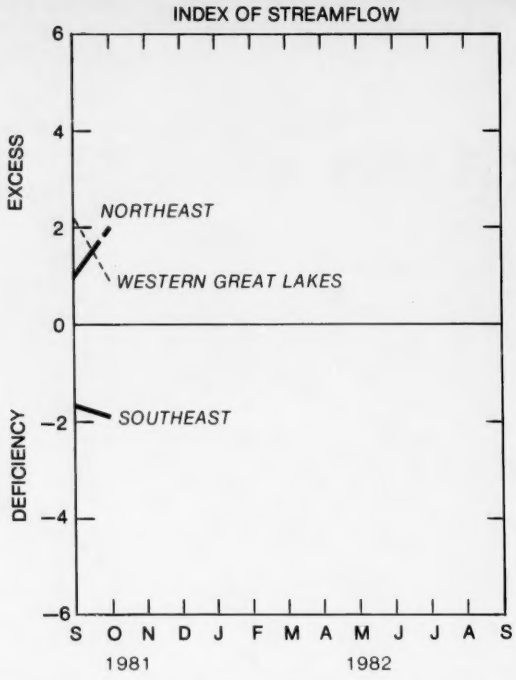
Streamflow increased in most of the West Region, southeastern Canada, most northern States in the Northeast and Western Great Lakes Regions, as well as in Texas, Oklahoma and Missouri. Monthly mean flows generally decreased in the Southeast Region, southwestern Canada, and in Alaska, Indiana, Iowa, Louisiana, and Ohio. Elsewhere flows were variable.

Below-normal streamflow persisted in eastern Nebraska, parts of Ontario and Quebec, and in a large area in and adjacent to Georgia. Daily mean flows were lowest of record for the month in parts of Florida and Georgia. Water-use restrictions remained in effect in parts of North Carolina.

Monthly mean flows remained in the above-normal range in parts of Texas and in a broad band across the northern tier of States extending from North Dakota to Maine. Monthly and/or daily mean flows were highest of record for the month in parts of Michigan and Maine. Flooding occurred in Oklahoma and Texas where peak discharges on several streams exceeded those likely to occur only once in 100 years.

Ground-water levels in the Northeast Region rose in most of New England and New York State. Levels generally declined in Maryland, Delaware, New Jersey, and Pennsylvania. Levels near the end of the month were above average in the northern parts of the region, and remained below average in Maryland, Delaware, northern New Jersey, and southeastern New York. In the Southeast Region, levels declined in Kentucky, Virginia, North Carolina, Mississippi, and in parts of Georgia and Florida, and rose in Alabama. Trends were mixed in West Virginia. In the Western Great Lakes Region, water levels rose in Minnesota, but trends were mixed elsewhere in the region. Levels were average in Ohio, and above and below average elsewhere. In the Midcontinent Region, levels rose but were below average in Arkansas, and mostly declined and were below average in Kansas. Trends were generally mixed in other States in the region. Levels were above and below average in Iowa and Texas. In the West, levels rose in Washington and declined in Montana; trends were mixed in other States. Levels were below average in Washington, Montana, and Arizona, and in most of Idaho and Utah. Levels were mixed with respect to average in other States in the region.

New high ground-water levels for October were reached in Vermont and Maine. A new high level for October, reached a year ago in Nevada, was equaled this year in the same observation well. New low levels for October occurred in Arizona, Delaware, Idaho, Kansas, Louisiana, Maryland, New Mexico, Tennessee, Texas, and Utah. New alltime low levels were reached in Virginia and Arizona.



The index of streamflow is computed by multiplying the percent of a region that is deficient (−) or excessive (+) by the average duration of deficiency or excess. During October, the index of streamflow deficiency for the Southeast worsened to a value of −1.87 when 44 percent (i.e., −0.44) of the area in the Southeast Region was deficient for an average duration of 4.25 months (−0.44 × 4.25 = −1.87). The index of streamflow excess in the Northeast Region increased to +2.0 during October. The value of the index dropped into the +1 to −1 range for the other regions during October.

NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

Streamflow increased seasonally except in Maryland, New Jersey, New York, and Pennsylvania, where flows were variable. Monthly mean flows remained in the above-normal range in parts of Maine, Massachusetts, New Hampshire, New York, Pennsylvania, and Vermont, and increased into that range in parts of Quebec and Nova Scotia. Below-normal streamflow persisted in parts of Quebec and New York. Daily mean flows were highest of record for October in parts of Maine.

Ground-water levels rose in most of New England and New York State. Levels generally declined in Maryland, Delaware, New Jersey, and Pennsylvania. Levels near end of month were above average in northern parts of the region, and remained below average in Maryland, Delaware, northern New Jersey, and southeastern New York.

STREAMFLOW CONDITIONS

In the Choptank River basin in eastern Maryland and the adjacent area of Delaware, where monthly mean flow of Choptank River near Greensboro, Md., was above the normal range and 3 times the median flow in September, mean discharge decreased, contrary to the normal seasonal trend, remained above median, but was within the normal range. (See graph on page 3.) In central Maryland, monthly mean flow of Seneca Creek at Dawsonville increased but remained in the normal range for the 6th consecutive month.

In central Pennsylvania, monthly mean discharge of Susquehanna River at Harrisburg increased sharply to 182 percent of median and was above the normal range for the first time since February. In the northwestern part of the State, mean flow of Allegheny River at

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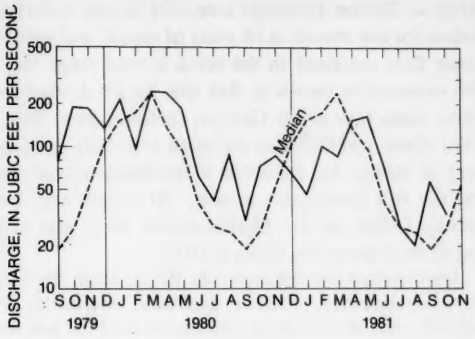


Monthly mean discharge of Choptank River near Greensboro, Md. (Drainage area, 113 sq mi; 293 sq km)

Natrona increased seasonally to over twice the median flow and remained in the above-normal range for the 3d consecutive month. Similarly, monthly mean flow of Oil Creek at Rouseville increased sharply to almost 4 times the October median flow and remained in the above-normal range for the 3d consecutive month.

In New Jersey, streamflow was variable, increasing seasonally in the northern part of the State, and decreasing, contrary to the normal seasonal pattern, at Great Egg Harbor River at Folsom, in southern New Jersey, but was generally within the normal range throughout the State. Reservoir elevations continued to decrease but were higher than those in October of last year.

In northern New York, monthly mean discharge of West Branch Oswegatchie River near Harrisville continued to increase seasonally and remained in the above-normal range for the 5th consecutive month. By contrast, on Long Island, monthly mean flow of Massapequa Creek at Massapequa decreased, contrary to the normal seasonal pattern, and remained in the below-normal range for the 14th consecutive month. Monthly mean flows of Susquehanna River at Conklin, Hudson River at Hadley, and Mohawk River at Cohoes ranged from 257 to 325 percent of median and remained in the above-normal range for the 2d consecutive month. Runoff from heavy rains at month end produced flash flooding and considerable property damage in southwestern New York and in some areas along the Mohawk River in the east-central part of the State.

In Connecticut, streamflow increased seasonally, ranged from 105 to 169 percent of median, and was within the normal range throughout the State.

In central New England, streamflow was above the normal range in all of Vermont and New Hampshire and in central Massachusetts, and was in the normal range elsewhere in Massachusetts and Rhode Island. For example, monthly mean flow of Pemigewasset River at Plymouth, New Hampshire increased seasonally to 433 percent of median and remained in the above-normal range for the 4th consecutive month.

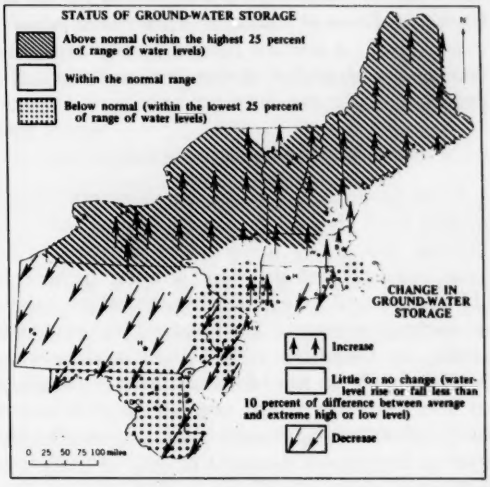
In Maine, streamflow increased seasonally and remained in the above-normal range at all index stations. In the central part of the State, the daily mean flow of 9,740 cfs on the 25th at Piscataquis River near Dover-Foxcroft (drainage area, 297 square miles) was highest for October in 80 years of record. Similarly, the daily mean flow of 36,500 cfs on October 29 at St. John River below Fish River, at Fort Kent, was highest for the month in 56 years of record.

In southern Nova Scotia, monthly mean discharge of LaHave River at West Northfield increased sharply to 280 percent of median and was above the normal range for only the third time in the past 21 months. Elsewhere in the Atlantic Provinces, flows increased seasonally, ranged from 143 to 174 percent of median at the respective index stations, and were in the normal range.

In Quebec, streamflow increased seasonally and was above the normal range at all index stations in the southern part of the Province that were south of the St. Lawrence River. By contrast, except for an index station in the extreme southwestern part of the Province, monthly mean flows at index stations located north of the St. Lawrence River were below the normal range and ranged from 51 percent of median at St. Maurice River at Grand Mere to 68 percent of median at Harricana River at Amos.

GROUND-WATER CONDITIONS

Ground-water levels rose in central and northern New England, and in most of New York State. (See map.)



Map shows ground-water storage near end of October and change in ground-water storage from end of September to end of October.

Levels continued to decline in New Jersey and Pennsylvania, and began declining in Maryland (except central part) and Delaware. Levels near end of month remained below average in Maryland, Delaware, northern New Jersey, and southeastern New York, and were at or near lowest levels of record (of 20 years or more) in some observation wells. These low levels contrasted with unusually high levels for October in some observation wells in northern parts of the region. Levels remained above average in Maine.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow generally decreased in Florida, Kentucky, Mississippi, North Carolina, and South Carolina, and was variable elsewhere in the region. Monthly mean discharges were below the normal range at 22 of the 37 index stations in the region and remained in that range in parts of Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia. Daily mean flows were lowest of record for the month in parts of Florida and Georgia. Below-normal flows have persisted for 16 months in parts of Florida and for 11 months in parts of Georgia. Flows remained in the above-normal range in parts of Kentucky and increased into that range in parts of Virginia. Restrictions on water use remained in effect in parts of North Carolina.

Ground-water levels declined in Kentucky, Virginia, North Carolina, Mississippi, and in parts of Georgia and Florida, and rose in Alabama. Trends were mixed in West Virginia. A new low for October was recorded in Tennessee, and a new alltime low was reached in Virginia.

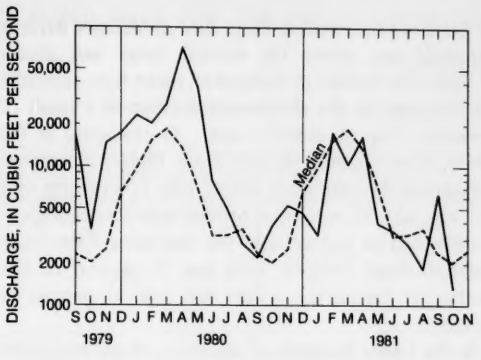
STREAMFLOW CONDITIONS

In the Suwannee River basin in southeastern Georgia, monthly mean discharge of Alapaha River at Statenville (drainage area, 1,400 square miles) continued to decrease seasonally and the monthly mean discharge of 30.5 cfs was only 2.1 cfs greater than the minimum October discharge of record. This was the 11th consecutive monthly mean discharge in the below-normal range and the 15th time in the past 16 months that mean discharge has been below the normal range at this site. Also in southeastern Georgia, monthly mean flow of Altamaha River at Doctortown decreased to only 38 percent of median and remained in the below-normal range for the 6th consecutive month. In the extreme northern part of the State, the daily mean discharge of 171 cfs in Etowah River at Canton (drainage area, 605 square miles) was lowest for any month in 56 years of record, and monthly mean flow remained in the below-normal range for the 4th consecutive month at that site. In the Apalachicola River basin in western Georgia, monthly mean flow of Flint River near Culloden increased seasonally to 45 percent of median but remained in the below-normal range for the 6th consecutive month. At month end, Lake Sidney Lanier on the Chattahoochie River was at its lowest level since first filling in 1957.

Downstream on Apalachicola River, mean discharge at Chattahoochee, Florida decreased seasonally, was only 62 percent of median, and approached the low flow of record during periods of nongeneration of energy at the Seminole dam. Also in northwestern Florida, monthly mean discharge of Shoal River near Crestview continued to decrease seasonally and remained below the normal range for the 7th time in the past 8 months. In northern Florida, mean flow of Suwannee River at Branford decreased seasonally and remained in the below-normal range for the 6th consecutive month. In central Florida, monthly mean discharge of Peace River at Arcadia (drainage area, 1,367 square miles) decreased seasonally, was only 19 percent of median, and remained in the below-normal range for the 15th time in the past 16 months. The daily mean discharge of 106 cfs on October 20 was lowest for the month since records began in April 1931. In the southern part of the State, mean flow of Fisheating Creek at Palmdale decreased seasonally and was below the normal range. In east-central Florida, monthly mean discharge of St. Johns River near Christmas decreased sharply to only 4 percent of median and remained in the below-normal range for the 16th consecutive month.

In southeastern Alabama, monthly mean flow of Conecuh River at Brantley continued to decrease seasonally, was only 32 percent of median, and remained in the below-normal range for the 8th consecutive month. In the west-central part of the State, mean flow of Tombigbee River at Demopolis lock and dam, near Coatopa, decreased sharply into the below-normal range and was less than half the median flow for the month. Elsewhere in the State, mean flows at index stations were within the normal range.

In southeastern Mississippi, where monthly mean discharge of Pascagoula River at Merrill was above the normal range and 266 percent of median during September, mean flow decreased sharply to only 56 percent of median in October and was below the normal range. (See graph on page 5.) Flows elsewhere in the State were generally less than median, but within the normal range. The variation of flow during the month was small with the maximum daily flows approximately twice the



Monthly mean discharge of Pascagoula River at Merrill, Miss. (Drainage area, 6,590 sq mi; 17,060 sq km)

minimums with slight rises occurring near midmonth and at month's end.

In South Carolina, monthly mean flows continued to decrease and remained below median at all index stations in the State. For example, in the eastern part of the State, mean flow of Lynches River at Effingham decreased, contrary to the normal trend, was only 50 percent of median, and remained in the normal range.

In North Carolina, streamflow was below the normal range across the State until the 26th when runoff from rains in the Piedmont caused bankfull stages in that region. Streamflow in the mountains and Coastal Plain remained in the below-normal range. For example, monthly mean discharge of Contentnea Creek at Hookerton continued to decrease seasonally, was only 21 percent of median, and was below the normal range. Precipitation, along with reduced rates of evapotranspiration due to cooler weather, have improved the water supply situation; however, some restrictions on water use remained in effect in the mountains in the western part of the State.

Similarly, streamflow in Virginia was below the normal range until the last week of the month when runoff from heavy rains lifted many streams into the above-normal category for the month. Despite the rain, monthly mean discharge of Nottoway River near Stony Creek (in the southern Piedmont) was only 16 percent of median and remained in the below-normal range for the 3d consecutive month. By contrast, mean flow of Slate River near Arvonia, in central Virginia, increased sharply to 3 times the October median flow and was above the normal range for the first time since January 1980.

In West Virginia, streamflow generally increased, ranged from 77 to 149 percent of median at the respective index stations, and was within the normal range throughout the State.

In northern Kentucky, monthly mean flow (adjusted for storage) of Licking River at Catawba decreased sharply and was below the normal range for the first time since March 1981. In the south-central part of the State, mean flow of Green River at Munfordville decreased slightly but remained in the above-normal range for the 6th consecutive month.

In eastern Tennessee, monthly mean discharge of French Broad River below Douglas Dam increased seasonally but remained in the below-normal range at one-half the median flow for October. Elsewhere in the State, monthly mean flows at index stations ranged from 85 to 512 percent of median and were within the normal range.

GROUND-WATER CONDITIONS

Ground-water levels in West Virginia rose and were above average in key wells in a few northern counties, and in Morgan County in the northeast, but declined and were below average elsewhere.

In Kentucky, levels declined seasonally, reflecting the below-average precipitation statewide during October. However, levels were generally above average owing to favorable ground-water recharge conditions during the last decade.

In Virginia, levels at three index wells showed continued declines of about ½ foot, and all were below average. The level in the Tyler well in Louisa County again reached an alltime low level in 29 years of record.

In western Tennessee, the level in the key artesian well in the "500-foot sand" aquifer near Memphis rose slightly, but was at a new October low, reflecting many years of municipal pumping.

In North Carolina, levels in shallow water-table wells continued to decline and were generally 1 to 3 feet below average.

In Mississippi, levels declined statewide. Levels in the Jackson metropolitan area declined less than a foot in the Cockfield Formation and as much as 5 feet in a few wells in the Sparta Sand. Slight declines were recorded in wells in the Mississippi River alluvium. Except for a few stations within the influence of heavy pumping, all reporting stations, including those in the Miocene and Graham Ferry Formations in southern Mississippi, and in the Wilcox and Upper Cretaceous aquifers in northern Mississippi, indicated normal early fall declines of less than 2 feet during October.

In Alabama, levels in key wells rose and were above and below average.

In Georgia, levels in the Piedmont declined as much as a foot. In Chatham County near the coast, levels in

the principal artesian aquifer near the center of pumping held steady or rose as much as 3½ feet, whereas the level in the water-table aquifer declined and was 2.3 feet below average. In Bryan and Liberty Counties, levels declined as much as 1½ feet. Near Brunswick, levels declined about 3 feet. In the southwest, levels declined as much as 1.7 feet.

In Florida, levels declined slightly at Jacksonville, and as much as 5.1 feet at Tampa. Levels were from 5 to nearly 12 feet below average in the principal aquifer in Florida and 8.5 feet below average in the sand and gravel aquifer in western Florida.

WESTERN GREAT LAKES REGION

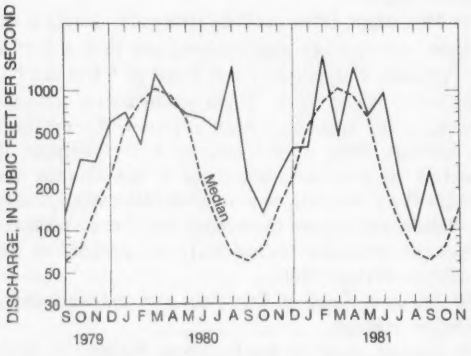
[Onatario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow generally increased in Michigan, Minnesota, and Wisconsin, decreased in Indiana and Ohio, and was variable elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of each State and Province in the Region. Below-normal flows persisted in parts of Ontario. Monthly mean flows were highest of record for the month in parts of Michigan.

Ground-water levels rose in Minnesota, but trends were mixed elsewhere in the region. Levels were average in Ohio and above and below average elsewhere.

STREAMFLOW CONDITIONS

In northeastern Ohio, where monthly mean discharge of Little Beaver Creek near East Liverpool was 427 percent of median in September, flow decreased sharply to near the median flow for October and was within the normal range. (See graph.) In the northwestern part of the State, where monthly mean flow of Maumee River at Waterville was above the normal range and almost 13 times the median in September, mean flow decreased but remained in the above-normal range as a result of increased flow at month's end. In reservoirs in the Scioto River basin upstream from Higby, month-end storage was 91 percent of last month, 124 percent of a year ago, and 91 percent of normal capacity. Storage at month's end in reservoirs in the Mahoning River basin upstream from Newton Falls was 78 percent of last month, 98 percent of a year ago, and 42 percent of capacity.



Monthly mean discharge of Little Beaver Creek near East Liverpool, Ohio (Drainage area, 496 sq mi; 1,285 sq km)

In the Upper Peninsula of Michigan, where mean flow of Sturgeon River near Sidnaw was below the normal range and only 39 percent of median in September, monthly discharge increased sharply to over twice the October median flow and was above the normal range for the first time since April as a result of runoff from heavy rains and some snowmelt near the end of the month. In southern Michigan, the monthly mean discharge of 578 cfs in Red Cedar River at East Lansing (drainage area, 355 square miles) was highest for October in 53 years of record, and remained in the above-normal range for the 2d consecutive month. In the northern part of the Lower Peninsula, mean flow of Muskegon River at Evart increased seasonally and remained in the normal range for the 4th consecutive month. Monthly mean levels of Houghton Lake near Houghton Lake Heights and Lake Mitchell-Cadillac at Cadillac were 0.37 foot and 0.14 foot above their respective median levels for October.

In southeastern Ontario, monthly mean discharge of Saugeen River near Port Elgin continued to increase seasonally, was 236 percent of median, and remained in the above-normal range. In the eastern part of the Province, north of Lake Huron, monthly mean flow of Missinaibi River at Mattice also increased seasonally but remained in the below-normal range for the 3d consecutive month as a result of low carryover flow from August and September. In the western part of the Province, monthly mean discharge of English River at Umfreville decreased, contrary to the normal seasonal trend, was only 23 percent of median, and remained in the below-normal range for 6th consecutive month.

In extreme northern Minnesota, in Lake of the Woods basin, where mean flow of Rainy River at Manitou Rapids was below the normal range in September and only 48 percent of median, flow increased sharply to 85 percent of the October median flow and was in the normal range. In central and east-central parts of the State, monthly mean flows of Crow River at Rockford and Minnesota River near Jordan, respectively, decreased but remained in the above-normal range for the 3d consecutive month. Elsewhere in the State, mean flows at

(Continued on page 8.)

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations in feet above National Geodetic Vertical Datum of 1929 (NGVD), formerly called sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.)

Lake	October 31, 1981	Monthly mean, October		October		
		1981	1980	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	600.46	600.48	601.03	600.96	601.93 (1951)	599.49 (1925)
Michigan and Huron (Harbor Beach, Mich.)	579.02	579.14	579.46	578.26	580.45 (1973)	575.77 (1964)
St. Clair (St. Clair Shores, Mich.)	574.74	574.80	574.67	573.22	575.35 (1973)	571.13 (1934)
Erie (Cleveland, Ohio)	571.70	571.72	571.67	570.12	572.14 (1973)	567.95 (1934)
Ontario (Oswego, N.Y.)	244.79	244.87	244.06	244.31	246.33 (1945)	241.72 (1934)

LAKE WINNIPEG AT GIMLI, MANITOBA

	Monthly mean, October				
Alltime high: 718.26 (July 1974). Alltime low: 709.62 (February 1941).	1981	1980	Average 1913–80	Maximum (year)	Minimum (year)
Elevation in feet above NGVD:	712.90	713.84	713.57	716.41 (1974)	709.93 (1940)

GREAT SALT LAKE

			October		
Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	October 31, 1981	October 31, 1980	Average, 1904–80	Maximum (year)	Minimum (year)
Elevation in feet above NGVD:	4,198.45	4,199.00	4,197.60	4,204.00 (1923)	4,191.35 (1963)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

			October		
Alltime high (1827–1980): 102.1 (1869). Alltime low (1939–1980): 92.17 (1941).	October 30, 1981	October 30, 1980	Average, 1939–78	Max. daily (year)	Min. daily (year)
Elevation in feet above NGVD:	98.18	94.77	94.63	99.04 (1978)	92.90 (1941)

FLORIDA

Site	October 1981		September 1981	October 1980
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	640	76	650	850
Miami Canal at Miami (southeastern Florida)	243	60	323	52
Tamiami Canal outlets, 40-mile bend to Monroe	292	54	912	238

(Continued from page 6.)
index stations generally increased into the above-normal range and were about twice their respective median flows.

In Wisconsin, runoff from moderate amounts of rainfall maintained streamflow that was above median throughout the State. In the southwestern part of the State, monthly mean discharge of Wisconsin River at Muscoda increased, contrary to the normal seasonal trend, and was above the normal range at 148 percent of median. In the east-central part of the State, mean flow of Fox River at Rapide Croche Dam near Wrightstown increased seasonally and remained in the above-normal range. Streamflows at both index stations are affected by regulation. Elsewhere in the State, flows were in the normal range.

In central Illinois, mean flow of Sangamon River at Monticello increased, contrary to the normal seasonal pattern, remained in the above-normal range for the 6th consecutive month, and was 2,313 percent of the October median discharge, as a result of high carryover flow from September and increased runoff from rainfall early in the month. In northern Illinois mean flows of Rock River near Joslin and Pecatonica River at Freeport (tributary to Rock River) remained in the above-normal range and were 278 percent and 266 percent of their respective median flows for October.

In western Indiana, and the adjacent area of eastern Illinois, mean flow of Wabash River, as measured at Mt. Carmal, Ill., decreased but remained in the above-normal range for the 6th consecutive month as a result of high carryover flow from September. All major reservoirs began releasing water by mid-month to obtain winter pool elevations by mid-November.

GROUND-WATER CONDITIONS

In Minnesota, ground-water levels in the key wells in the central and south-central parts of the State rose slightly. The level in central Minnesota continued below average, while that in the Hanska well in the south was nearly 4 feet above average. In the Minneapolis-St. Paul area, artesian levels in wells tapping the Prairie du Chien-Jordan aquifer continued rising sharply and were 8 to 9 feet above average; levels in wells tapping the deeper Mount Simon-Hinckley aquifer were fairly stable and ranged from 1 foot below average to 5 feet above.

In Michigan, levels in the Lower Peninsula declined slightly in the north, and rose in the south; they were close to average in both areas. In the western part of the Upper Peninsula the level in the key well rose slightly and continued slightly below average.

In Wisconsin, water levels generally rose in the southeastern half of the State but declined in the northwest. Levels in wells in the heavily pumped parts of the State rose in response to decreased pumping. However, the level in the key well in the southeastern part of the State declined.

In northwestern Illinois, the level in the water-table well in glacial drift at Princeton, in Bureau County, rose less than a foot and was 5½ feet above average.

In Indiana, water levels declined gradually during the month but continued above average except in the southeastern part of the State, where they were slightly below average.

Water levels in wells in Ohio declined in the northeast but rose slightly in the central part of the State. Levels were about normal in both areas.

MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

Streamflow generally increased in Texas, Oklahoma, Missouri, Saskatchewan, and parts of Kansas, decreased in Iowa and Louisiana, and was variable elsewhere in the region. Extreme flooding occurred in north-central Texas and south-central Oklahoma. Monthly mean flows remained in the above-normal range in North Dakota, and increased into that range in Oklahoma and most of Texas. Mean flows remained in the below-normal range in southwestern Iowa, eastern Nebraska and southwestern Louisiana.

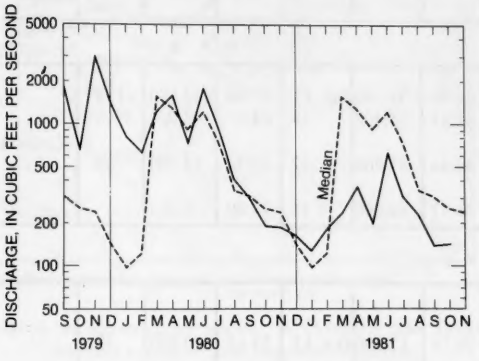
Ground-water levels rose but were below average in Arkansas, and mostly declined and were below average in Kansas. Trends were generally mixed in other States. Levels were above and below average in Iowa and Texas. New low levels for October were recorded in wells in Kansas, Louisiana, and Texas.

STREAMFLOW CONDITIONS

In southern Saskatchewan, monthly mean discharge of Qu'Appelle River near Lumsden decreased seasonally and was in the normal range following 3 consecutive months of flow in the above-normal range.

In southwestern North Dakota, mean discharge of Cannonball River at Breien decreased seasonally but remained in the above-normal range for the 3d consecutive month. In the eastern part of the State, mean flow of Red River of the North at Grand Forks increased seasonally and remained in the above-normal range. Mean flows at these two index stations were both 1¾ times their respective medians. Month-end content of Lake Sakakawea was 75 percent of normal maximum and 15 percent less than average for end of October.

In central South Dakota, Bad River near Fort Pierre (drainage area, 3,107 square miles) remained dry for the 2d consecutive month. In the eastern part of the State, mean flow of Big Sioux River, as measured at Akron, Iowa, increased slightly and was in the normal range. (See graph.) Total month-end contents of principal reservoirs decreased slightly.



Monthly mean discharge of Big Sioux River at Akron, Iowa (Drainage area, 9,030 sq mi; 23,390 sq km)

In northeastern Nebraska, mean discharge of Elkhorn River at Waterloo decreased, contrary to the normal seasonal trend, and was below the normal range for the 14th time in the past 16 months. The monthly mean flow was 64 percent of median for the month. In the northwestern part of the State, mean discharge of Niobrara River above Box Butte Reservoir was in the normal range. Contents of Lake McConaughy increased and was 15 percent higher than average at the end of the month. Reservoirs in the Republican River basin except for Harry Strunk Lake were filling slowly and were at higher levels than a year ago.

In southwestern Iowa, mean discharge of Nishnabotna River above Hamburg remained below the normal range for the 8th consecutive month and was 37 percent of median. Elsewhere in the State, mean flows of Cedar River at Cedar Rapids and Des Moines River at Ft. Dodge also decreased and returned to the normal range after several months of flow in the above-normal range but remained above median.

In Missouri, streamflow increased but remained in the normal range. Monthly mean flows ranged from 72 to 125 percent of median.

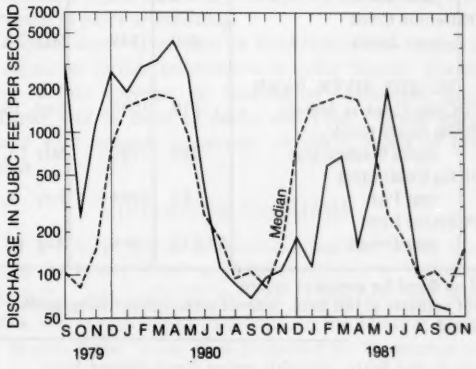
In northeastern Kansas, monthly mean flow in the Little Blue River near Barnes remained below the normal range and was 55 percent of median. Elsewhere in the State, mean flows increased and were in the normal range.

In Oklahoma, streamflow was in the normal range except in the south-central part, where flooding occurred as a result of runoff from the heavy rains of October 13–16, which covered an area about 150 miles wide extending from west of San Angelo, Texas, to Lake Texoma in Oklahoma. Selected data on stages, discharges, and gaging station locations are given in the accompanying table and map on pages 10, 11. The flooding in Oklahoma was estimated to be that of a 25-year flood event. The mean flow of Washita River near Durwood increased sharply to 9 times median and was above the normal range. Fed by the heavy rains, Lake Texoma exceeded its normal maximum capacity.

In Texas, streamflow increased sharply and was above the normal range except in the coastal plain of Brazos River and Colorado River basins, where mean flows were in the normal range. Rapid runoff from heavy rains in excess of 20 inches during October 13–16 caused severe flooding on many rivers in central Texas. Selected data on stages, discharges, recurrence intervals, and gaging station locations are given in the accompanying table and map. In the San Angelo area, monthly mean flow of North Concho River near Carlsbad was 448 times median. In northeastern Texas, mean flow of Neches River near Rockland was 5½ times median. Also in south-central Texas, mean flow of Guadalupe River near Spring Branch was 8½ times median. Records for 38 reservoirs show that 33 increased in contents and 5 decreased.

In Arkansas, streamflow remained in the normal range. Monthly mean flows were slightly above median.

In Louisiana, streamflow decreased seasonally. Mean flow of Calcasieu River near Oberlin remained below the normal range and was 67 percent of median. (See graph.)



Monthly mean discharge of Calcasieu River near Oberlin, La. (Drainage area, 753 sq mi; 1,950 sq km)

STAGES AND DISCHARGES FOR THE FLOODS OF OCTOBER 1981 AT SELECTED SITES IN OKLAHOMA AND TEXAS

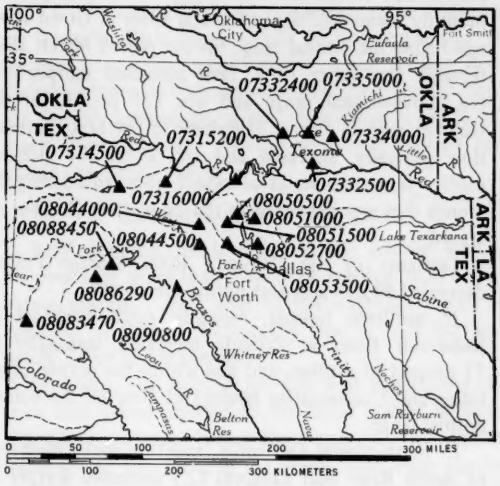
WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously[1] known			Maximum during present flood				
				Date	Stage (feet)	Discharge (cfs)	Date	Stage (feet)	Discharge		Recurrence interval (years)
									Cfs	Cfs per square mile	
	OKLAHOMA										
	RED RIVER BASIN										
07332400	Blue River at Milburn	203	1965–	Oct. 8, 1970	27.87	35,100	Oct. 13	27.44	32,160	158	.....
07332500	Blue River near Blue	476	1936–	Feb. 17, 1938	31.81	34,400	14	44.2	N/A	.....	.....
07334000	Muddy Boggy Creek near Farris	1,087	1937–	June 17, 1945	44.94	61,900	17	42.74	32,700	30	.....
07335000	Clear Boggy Creek near Caney	720	1942–	Dec. 11, 1946	26.77	52,800	14	27.00	N/A	.....	.....
	TEXAS										
	RED RIVER BASIN										
07314500	Little Wichita River near Archer City	481	1932–	Oct. 31, 1941	26.18	17,900	Oct. 13	25.63	10,500	22	.....
07315200	East Fork Little Wicheta River near Henrietta ...	178	1963–	May 12, 1972	28.85	15,500	13	31.70	35,000	197	>100
07316000	Red River near Gainsville	30,782	1936–	June 9, 1941	24.15	168,000	14	29.45	N/A	.....	.....
	TRINITY RIVER BASIN										
08044000	Big Sandy Creek near Bridgeport	333	1936–	June 10, 1941	15.69	53,000	13	15.22	44,000	132	.....
08044500	West Fork Trinity River near Boyd	1,725	1947–	Oct. 5, 1959	22.17	27,300	13	26.27	*54,000	31	>100
08050500	Elm Fork Trinity River near Sanger	381	1949–	Oct. 31, 1974	29.10	50,000	13	32.10	*145,000	.....	>100
08051000	Isle DuBois Creek near Pilot Point	266	1949–	Oct. 31, 1974	29.43	40,000	13	30.22	58,000	218	>100
08051500	Clear Creek near Sanger ...	295	1949–	Sept. 13, 1950	24.80	18,200	13	35.64	*75,000	254	>100
08052700	Little Elm Creek near Aubrey	75.5	1956–	Oct. 31, 1974	17.04	7,920	13	17.32	9,400	125	20
08053500	Denton Creek near Justin	400	1949–	May 24, 1957	17.64	29,800	13	18.66	44,000	110	80
	BRAZOS RIVER BASIN										
08083470	Cedar Creek at Abilene ...	119	1970–	Sept. 18, 1974	12.54	4,670	13	16.80	N/A	.....	.....
08086290	Big Sandy Creek above Breckenridge	280	1962–	May 13, 1975	23.30	8,170	13	28.60	N/A	.....	.....
08088450	Big Cedar Creek near Ivan	97	1964–	July 8, 1968	22.39	9,590	13	32.50	30,100	310	.....
08090800	Brazos River near Dennis	25,237	1968–	Aug. 10, 1978	25.86	59,300	14	31.85	96,000	4	.....

[1] Based on flood for period of record.
N/A Not available at this time. Indirect measurement being made.
*Estimated.

Elsewhere in the State, monthly mean flows ranged from 80 to 84 percent of median and were in the normal range. Contents of Toledo Bend Reservoir increased 28,000 acre-foot during the month.

GROUND-WATER CONDITIONS

In North Dakota, the ground-water level in the key well in the western part of the State declined, but the



Location of stream-gaging stations in Oklahoma and Texas, described in table of peak stages and discharges.

level in the key well in the eastern part of the State rose almost a foot.

Levels in Nebraska rose in most wells in irrigated areas, reflecting seasonal recovery from irrigation withdrawals. Levels declined in most shallow observation wells and were slightly below long-term averages.

In Iowa, levels in shallow wells rose and were above average except in the southwestern part of the State, where levels declined and were below average.

In Kansas, levels declined in three of the four key wells. New low levels for October were recorded in the Halstead well in Harvey County, in south-central Kansas, in 41 years of record, and in the Kansas Agricultural Experiment Station well at Colby, in Thomas County, in 34 years of record--the latter in spite of a net rise of nearly 2 feet during October.

In Arkansas, the level in the key well in the deep Sparta Sand aquifer rose 23 feet, but was 32 feet below average for October. In the industrial aquifer of central and southern Arkansas—also the Sparta Sand—the level in the key well at Pine Bluff rose slightly but was 42 feet below average. The level in the well at El Dorado rose 3½ feet but was 11 feet below average.

In Louisiana, levels in wells in the "400-foot" and "600-foot" sands approached seasonal lows, declining ½ to 14 feet. Levels in many wells in the "1,200-foot" and "2,000-foot" sands have risen since summer, while levels in most observation wells in the "1,500-foot", "2,400-foot", and "2,800-foot" sands have declined slightly. In the New Orleans area, levels in wells in the Gramercy and Norco aquifers were near seasonal lows during October, while levels in wells in the Gonzales-New Orleans aquifer recovered slightly. Slight declining trends continued in observation wells in the Sparta Sand and Miocene aquifers in northern and central Louisiana. Measurements in wells in the Wilcox, Cockfield, terrace, and alluvial aquifers indicate normal seasonal levels. October levels in wells in the Chicot aquifer of southwestern Louisiana generally rose. Water levels rose about 1.5 to 6 feet in most of the rice-growing area, but declined less than ½ foot in the Lafayette and Opelousas areas. In the Lake Charles industrial area, water levels rose nearly a foot in wells in the "200-foot" and "700-foot" sands, but declined about a foot in wells in the "500-foot" sand. Levels in observation wells in the Evangeline aquifer declined nearly 10 feet in Opelousas, but rose slightly near Eunice. A new low level for October was recorded in the well near Iowa, La., despite a net rise of nearly 4 feet.

In Texas, levels rose and were above average in wells in the Edwards Limestone at Austin and San Antonio. The level in the well in the Evangeline aquifer at Houston declined more than a foot, reaching a new October low in 17 years of record. Despite a rise of ½ foot, a new October low was also recorded in the well in the bolson deposits at El Paso, in 17 years of record.

WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

Streamflow generally increased seasonally in Idaho, Nevada, Oregon, Washington, and Wyoming, decreased in Alberta and British Columbia, and was variable elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of Washington and increased into that range in parts of Arizona, California, Colorado, Oregon, and Utah. Below-normal streamflow persisted in parts of Montana.

Ground-water levels rose in Washington and declined in Montana; trends were mixed in other States. Levels were below average in Washington, Montana, and Arizona, and in most of Idaho and Utah. Levels were mixed with respect to average in other States in the region.

STREAMFLOW CONDITIONS

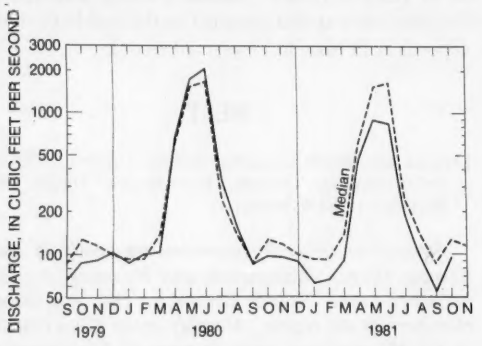
In southern British Columbia, monthly mean discharge in Fraser River at Hope continued to decrease seasonally, was only 71 percent of median, and was below the normal range. Similarly, in the adjacent basin of Skeena River, mean flow decreased to 78 percent of median and was below the normal range for the first time since July 1980.

In western Alberta, where monthly mean flow of Bow River at Banff was above the normal range from July 1981 through September 1980, mean flow decreased seasonally and was within the normal range.

In northwestern Montana, monthly mean discharge of Marias River near Shelby increased seasonally to 56 percent of the October median flow but remained in the below-normal range for the 2d consecutive month. In the southern part of the State, mean flow of Yellowstone River at Corwin Springs continued to decrease seasonally and remained in the below-normal range for the 4th consecutive month. Elsewhere in the State, monthly mean flows of index stations increased but remained below median and within the normal range.

In Wyoming and Idaho, streamflow generally increased seasonally, was near or slightly below median, and within the normal range. In Idaho, reservoir storage for irrigation was below average.

In northwestern Colorado, where mean flow of Yampa River at Steamboat Springs was below the normal range in 9 of the past 11 months, flow increased seasonally and remained below median but was within the normal range in October. (See graph.) In the southwestern part of the State, monthly mean discharge of



Monthly mean discharge of Yampa River at Steamboat Springs, Colo. (Drainage area, 604 sq mi; 1,564 sq km)

Animas River at Durango increased, contrary to the normal seasonal trend, and was above the normal range for the first time since June 1980. Elsewhere in Colorado, flows at index stations were above median but within the normal range.

In New Mexico, monthly mean flows were within the normal range and ranged from 98 to 153 percent of median at the index stations.

In Arizona, monthly mean flows at index stations on the Gila, Salt, Verde, and Little Colorado Rivers increased, contrary to the normal seasonal trend, were above the normal range, and ranged from 151 percent of median on Salt River near Roosevelt to 865 percent of median on Little Colorado River near Cameron. Elsewhere in the State, flows were within the normal range.

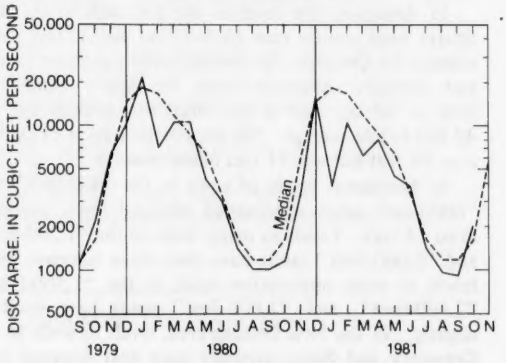
In southeastern Utah, mean flow of San Juan River near Bluff increased seasonally to 191 percent of median and was above the normal range for the first time since June 1980. In the east-central part of the State, where monthly mean discharge of Green River at Green River was below the normal range for the period March 1981 through September 1981, flow increased sharply into the above-normal range and was 131 percent of the October median flow. Elsewhere in the State, streamflow generally increased and was above the October median flows as a result of runoff from rains during the month that was described as the 2d wettest October on record.

Contents of the Colorado River Storage Project decreased 89,319 acre-feet during the month.

In northern Nevada, monthly mean discharge of Humboldt River at Palisade increased seasonally to 75 percent of median, and was within the normal range following 7 consecutive months of flow in the below-normal range.

In north-coastal California, monthly mean discharge of Smith River near Crescent City increased sharply to 329 percent of median, and was above the normal range for the first month since March 1980. Elsewhere, unregulated monthly flows increased seasonally in most streams. Flow was in the normal range at other index stations in the State and near the median flow for October. Combined contents of 10 index reservoirs in central and northern California decreased seasonally and at month's end were 97 percent of average and 78 percent of the contents one year ago.

In north-coastal Oregon, monthly mean flow of Wilson River near Tillamook increased seasonally to 175 percent of median in October and was above the normal range. In the southwestern part of the State, monthly mean discharge of Umpqua River near Elkton increased seasonally to 118 percent of median and was typical of the normal trend in streamflow at that site and elsewhere in Oregon. (See graph.)



Monthly mean discharge of Umpqua River near Elkton, Oregon (Drainage area, 3,683 sq mi; 9,539 sq km)

In southwestern Washington, monthly mean discharge of Chehalis River near Grand Mound continued to increase seasonally, was over twice the median flow during October, and remained in the above-normal range for the 2d consecutive month. Elsewhere in the State, mean flows at index stations were near median and within the normal range.

GROUND-WATER CONDITIONS

In Washington, the level in the key artesian well in Tacoma rose more than 2 feet but was less than a foot below average. The level in the water-table well in Spokane in eastern Washington rose ¾ foot but was nearly 2 feet below average.

In Idaho, the level in the key well penetrating the sand and gravel aquifer in the Boise Valley declined 2 feet but continued ½ foot above average. The levels in three of the key wells in the Snake River Plain aquifer recorded new month-end lows--near Atomic City, in 32 years of record; in the Rupert-Minidoka area, in 31 years of record; and near Eden, in 24 years of record. The level in the well near Gooding rose more than a foot but continued below average by nearly 7 feet. The level in the key well in the alluvial aquifer underlying the Rathdrum Prairie in northern Idaho rose slightly but continued below average by 5 feet.

In Montana, the level in the water-table observation well at the Hamilton Fairground declined more than 3 feet and was slightly below average. The level in the Stahl well at Missoula declined more than a foot and was slightly below average.

In southern California, levels in key wells in Santa Barbara County rose at Lompoc and declined at Cuyama and Santa Maria; levels were above average.

In Nevada, the level in the observation well in Paradise Valley declined and was below average. In Las Vegas Valley, the level rose but was below average in the key well; in Steptoe Valley the level rose, was above average, and equaled the October high set a year ago.

In Utah, levels rose in wells in the Flowell and Logan areas but were below average. The level in the well in the Blanding declined but was above average. The level in the key well in the Holladay area rose nearly 6 feet, but nevertheless was at a new low level for October in 39 years of record.

In Arizona, levels declined in two index wells and rose in two others. Despite a rise of 3 feet in the well at Elfrida, the level was at a new low for October in 30 years of record. One other index well was reported to have recorded a new alltime low.

In New Mexico, the water level in the Berrendo-Smith well rose and was nearly 3 feet above average. The level in the Lovington well rose slightly but continued below average by 11 feet. The level in the Dayton well declined slightly, reaching a new October low in 43 years of record. At the Hrna well, the level rose ½ foot and was more than 5 feet above average.

ALASKA

Streamflow throughout Alaska declined seasonally and was within the normal range. For example, in the south-central part of the State, monthly mean discharge of Little Susitna River near Palmer decreased seasonally, was 102 percent of median, and was within the normal range for the first time since May 1981.

Ground-water levels in the Anchorage area generally declined up to 2 feet except in areas where the aquifer was recovering from heavy pumping.

HAWAII

Streamflow decreased, contrary to the normal seasonal trend, at index stations on the islands of Kauai, Oahu, and Maui. By contrast, monthly mean discharge of Waiakea Stream near Mountain View, Island of Hawaii, increased to 137 percent of median and was in the above-normal range for the first time since October 1980. On the Island of Oahu, monthly mean discharge of Kalihi Stream near Honolulu decreased to only 22 percent of median and remained in the below-normal range. Elsewhere in the State, flows at index stations were within the normal range.

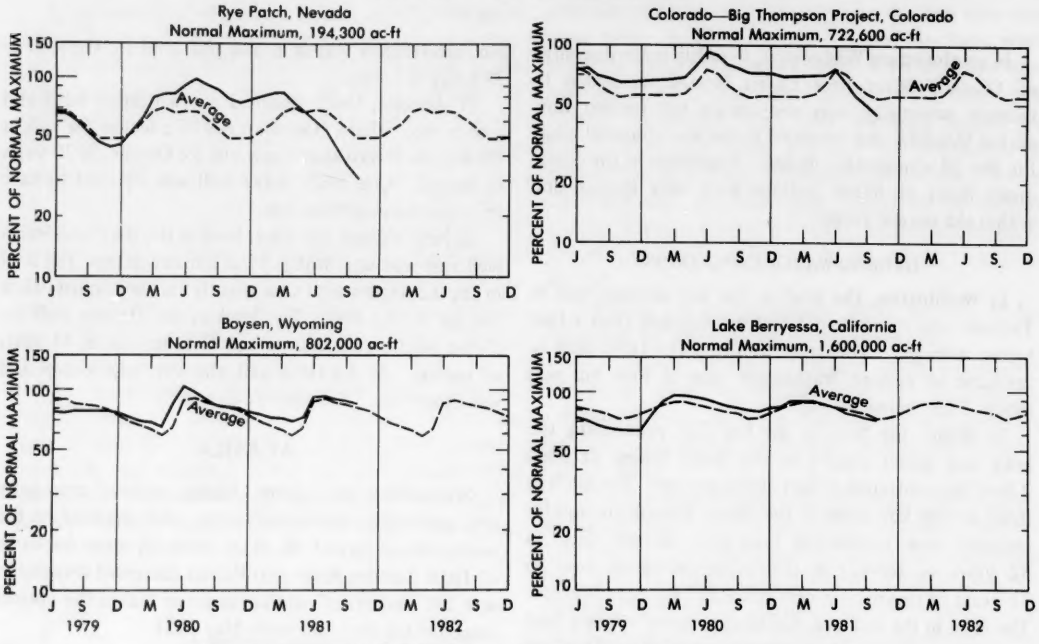
On Guam, Mariana Islands, mean flow of Ylig River near Yona increased to 78 percent of median but remained in the below-normal range for the 2d consecutive month.

METRIC EQUIVALENTS OF UNITS USED IN THE WATER RESOURCES REVIEW

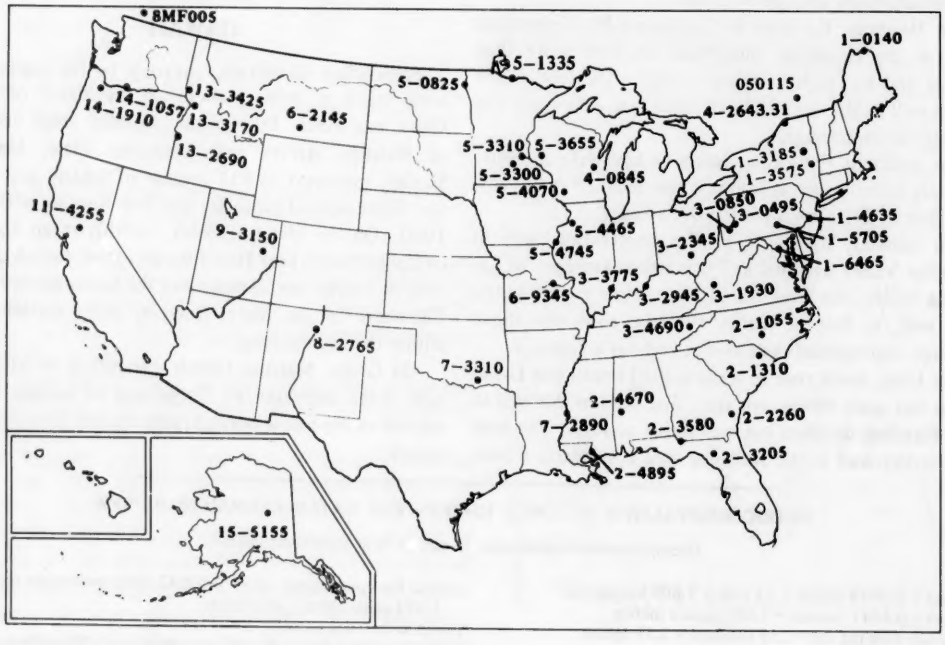
(Round-number conversions, to nearest four significant figures)

1 foot = 0.3048 meter 1 mile = 1.609 kilometers
1 acre = 0.4047 hectare = 4,047 square meters
1 square mile (sq mi) = 259 hectares = 2.59 square kilometers (sq km)
1 acre-foot (ac-ft) = 1,233 cubic meters
1 million cubic feet (mcf) = 28,320 cubic meters
1 cubic foot per second (cfs) = 0.02832 cubic meters per second = 1.699 cubic meters per minute
1 second-foot-day (cfsd) = 2,447 cubic meters
1 million gallons (mg) = 3,785 cubic meters = 3.785 million liters
1 million gallons per day (mgd) = 694.4 gallons per minute (gpm) = 2.629 cubic meters per minute = 3,785 cubic meters per day

USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS JUNE 1979 TO OCTOBER 1981



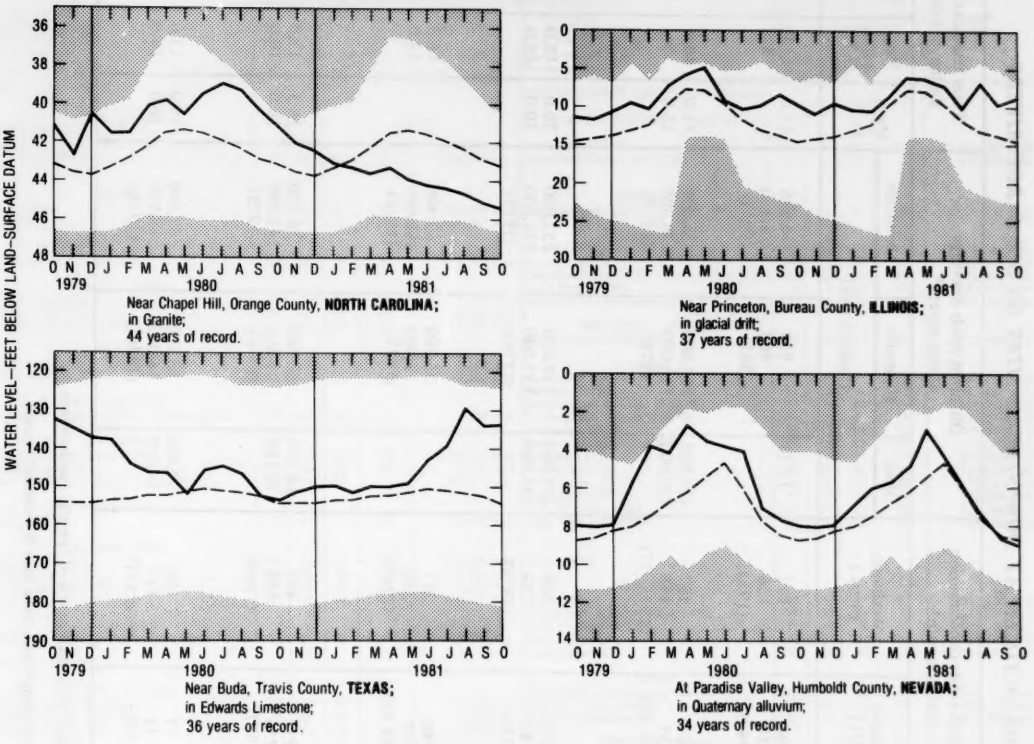
SELECTED STREAM-GAGING STATIONS ON LARGE RIVERS



Location of stream-gaging stations on large rivers listed in table on page 18.

MONTH-END GROUND-WATER LEVELS IN KEY WELLS

UNSHADED AREA INDICATES RANGE BETWEEN HIGHEST AND LOWEST RECORD FOR THE MONTH
DOTTED LINE INDICATES AVERAGE OF MONTHLY LEVELS, IN PREVIOUS YEARS
HEAVY LINE INDICATES LEVEL FOR CURRENT PERIOD



DISSOLVED SOLIDS AND WATER TEMPERATURES FOR OCTOBER ON SIX LARGE RIVERS

The table on page 16 shows dissolved-solids and temperature data for October at six stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). NASQAN, as established by the U.S. Department of the Interior, Geological Survey, is designed to describe the water quality of the Nation's streams and rivers on a systematic and continuing basis, so as to meet many of the information needs of those involved in national or regional water-quality planning and management.

"Dissolved solids," as described in several columns of the table, are minerals dissolved in water and usually consist predominantly of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. These same minerals are among the most common components of the Earth's solid rocks and minerals, but gradually erode and at least partly dissolve as a part of natural weathering processes. Collectively these and other dissolved minerals constitute the dissolved-solids concentration expressed in milligrams per liter (mg/L) or the generally equivalent expression, parts per million (parts of dissolved matter in one million parts of water, by weight). Values of dissolved solids are convenient for comparing the quality of water from one time to another and from one place to another. Most drinking water contains between 50 and 500 mg/L of dissolved solids.

"Dissolved-solids discharge," expressed in tons per day, represents the total daily amount of dissolved minerals carried by the stream and is calculated by multiplying the dissolved-solids concentration (in mg/L) by the stream discharge (in cfs; times a unit conversion factor of .0027). Even though dissolved-solids *concentrations* are generally higher during periods of low streamflow than of high streamflow, the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at time of low flow.

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR OCTOBER AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	October data of following calendar years	Stream discharge during month	Dissolved-solids concentration during month[a]		Dissolved-solids discharge during month[a]			Water temperature during month[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean	Minimum	Maximum	Mean, in °C	Minimum, in °C	Maximum, in °C
						(tons per day)					
	NORTHEAST										
01463500	Delaware River at Trenton, N.J. (Morrisville, Pa.)	1981	4,462	106	122	1,376	918	4,446	13.5	11.0	17.0
		1945–80	6,849	58	156	.....	463	8,300	.....	8.5	25.5
		(Extreme yr)		(1945)	(1953)		(1963)	(1955)			
			[c]4,025								
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, N.Y. median streamflow at Ogdensburg, N.Y.	1981	299,000	164	167	133,000	133,000	134,000	11.0	10.0	14.0
		1975–80	290,500	165	168	130,000	115,000	138,000	13.0	0	17.0
		(Extreme yr)		(1979–80)	(1975–77)		(1978)	(1977)			
			[c]234,500								
	SOUTHEAST										
07289000	Mississippi River at Vicksburg, Miss.	1981	275,600	275	309	214,000	179,000	252,000	20.0	15.0	24.0
		1975–80	389,200	183	282	234,000	117,000	356,000	20.0	15.0	26.0
		(Extreme yr)		(1979)	(1978)		(1976)	(1979)			
			[c]264,200								
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill. (25 miles west of Paducah, Ky.; streamflow station at Metropolis, Ill.)	1981	90,300	180	227	.....	35,200	63,400	.....	16.0	21.0
		1955–80	121,900	135	330	.....	15,000	262,000	.....	12.0	26.0
		(Extreme yr)		(1960, 63)	(1967)		(1973)	(1976)			
			[c]89,100								
	MIDCONTINENT										
06934500	Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1981	52,800	392	492	66,000	60,500	86,100	16.5	12.0	21.0
		1975–80	63,650	236	558	71,100	51,800	142,000	16.0	10.0	22.5
		(Extreme yr)		(1977)	(1980)		(1976)	(1975)			
			[c]55,340								
	WEST										
14128910	Columbia River at Warrendale, Oreg. (streamflow station at The Dalles, Oreg.)	1981	122,000	73	101	30,900	13,200	42,000	15.0	13.0	18.0
		1975–80	115,000	78	117	30,000	16,000	48,900	16.0	14.0	19.5
		(Extreme yr)		(1976)	(1977)		(1978)	(1975)			
			[c]100,400								

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.

Provisional data; subject to revision

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF OCTOBER 1981

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F—Flood control I—Irrigation M—Municipal P—Power R—Recreation W—Industrial	End of Sept. 1981	End of Oct. 1981	End of Oct. 1980	Average for end of Oct.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	44	40	40	35	226,300 (a)
QUEBEC					
Allard (P)	82	85	91	55	280,600 ac-ft
Gouin (P)	72	66	81	65	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	88	95	53	52	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	78	79	71	74	3,330 mcf
Lake Francis (FPR)	85	89	80	76	4,326 mcf
Lake Winnipesaukee (PR)	84	97	64	55	7,220 mcf
VERMONT					
Harriman (P)	66	79	67	61	5,060 mcf
Somerset (P)	57	65	76	69	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	70	69	66	71	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	72	87	53	54	34,270 mcf
Indian Lake (FMP)	88	84	90	55	4,500 mcf
New York City reservoir system (MW)	60	60	45	....	547,500 mg
NEW JERSEY					
Wanaque (M)	54	46	38	63	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	43	44	32	32	51,400 mcf
Pymatuning (FMR)	107	93	78	78	8,191 mcf
Raystown Lake (FR)	66	66	52	50	33,190 mcf
Lake Wallenpaupack (PR)	47	47	48	48	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	75	71	82	84	83,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	89	85	87	80	12,580 mcf
Narrows (Badin Lake) (P)	93	84	90	95	5,616 mcf
High Rock Lake (P)	72	54	39	58	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	83	80	83	62	70,300 mcf
Lakes Marion and Moultrie (P)	81	79	94	65	81,100 mcf
SOUTH CAROLINA—GEORGIA					
Clark Hill (FP)	40	35	64	54	75,360 mcf
GEORGIA					
Burton (PR)	90	90	87	66	104,000 ac-ft
Sinclair (MPR)	79	76	75	76	214,000 ac-ft
Lake Sidney Lanier (FMPR)	41	34	48	52	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	87	83	85	66	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	36	32	24	33	1,156,000 cfsd
Douglas Lake (FPR)	26	19	18	24	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	51	45	54	49	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	46	39	39	39	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	55	45	45	48	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	71	87	95	77	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	50	62	92	63	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	33	34	21	29	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	75	75	81	90	22,700,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	50	51	66	73	127,600 ac-ft
Bell Fourche (I)	19	24	19	35	185,200 ac-ft
Lake Francis Case (FIP)	68	52	60	57	4,834,000 ac-ft
Lake Oahe (FIP)	66	64	72	....	22,530,000 ac-ft
MIDCONTINENT REGION—Continued					
SOUTH DAKOTA—Continued					
Lake Sharpe (FIP)	100	100	103	94	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	92	94	96	95	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	73	76	74	66	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	77	104	74	83	2,378,000 ac-ft
Keystone (FPR)	84	92	75	86	661,000 ac-ft
Tenkiller Ferry (FPR)	89	96	83	89	628,200 ac-ft
Lake Altus (FIMR)	9	8	21	48	133,000 ac-ft
Lake O'The Cherokees (FPR)	88	92	72	81	1,492,000 ac-ft
OKLAHOMA—TEXAS					
Lake Texoma (FMPRW)	82	138	87	92	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	31	101	27	44	386,400 ac-ft
Canyon (FMR)	91	70	93	72	385,600 ac-ft
International Amistad (FIMPW)	100	109	90	85	3,497,000 ac-ft
International Falcon (FIMPW)	101	100	73	78	2,668,000 ac-ft
Livingston (IMW)	100	102	84	78	1,788,000 ac-ft
Possum Kingdom (IMPRW)	89	98	95	101	570,200 ac-ft
Red Bluff (PI)	16	16	21	27	307,000 ac-ft
Toledo Bend (P)	88	88	81	76	4,472,000 ac-ft
Twin Buttes (FIM)	36	42	37	30	177,800 ac-ft
Lake Kemp (IMW)	57	59	42	85	268,000 ac-ft
Lake Meredith (IMW)	36	37	21	37	821,300 ac-ft
Lake Travis (FIMPRW)	87	101	106	79	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	93	91	89	87	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	98	99	98	100	5,022,000 ac-ft
Lake Chelan (PR)	90	83	78	76	676,100 ac-ft
Lake Cushman	91	87	90	86	359,500 ac-ft
Lake Merwin (P)	98	99	99	85	245,600 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	45	46	60	47	1,235,100 ac-ft
Coeur d'Alene Lake (P)	76	60	57	54	238,900 ac-ft
Pend Oreille Lake (FP)	87	59	55	70	1,561,000 ac-ft
IDAHO—WYOMING					
Upper Snake River (8 reservoirs) (MP)	38	35	58	49	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	89	87	82	82	802,000 ac-ft
Buffalo Bill (IP)	60	54	73	74	421,300 ac-ft
Keyhole (F)	22	21	52	44	190,400 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	40	40	57	43	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	5	4	10	11	364,400 ac-ft
Taylor Park (IR)	52	46	56	54	106,200 ac-ft
Colorado-Big Thompson project	49	44	71	55	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	81	81	89	.....	1,620,000 ac-ft
UTAH—IDAHO					
Bear Lake (IPR)	62	61	79	58	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	62	56	63	53	1,000,000 ac-ft
Hetch Hetchy (MP)	62	51	70	48	360,400 ac-ft
Isabella (FIR)	30	30	48	23	568,100 ac-ft
Pine Flat (FI)	32	34	69	37	1,001,000 ac-ft
Clair Engle Lake (Lewiston) (P)	71	68	76	68	2,438,000 ac-ft
Lake Almanor (P)	59	66	89	49	1,036,000 ac-ft
Lake Berryessa (FIMW)	73	72	81	73	1,600,000 ac-ft
Millerton Lake (FI)	33	35	41	32	503,200 ac-ft
Shasta Lake (FIPR)	56	58	74	64	4,377,000 ac-ft
CALIFORNIA—NEVADA					
Lake Tahoe (IPR)	27	21	83	48	744,600 ac-ft
NEVADA					
Rye Patch (I)	36	31	79	52	194,300 ac-ft
ARIZONA—NEVADA					
Lake Mead and Lake Mohave (FIMP)	83	84	89	69	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	24	24	64	14	1,073,000 ac-ft
Salt and Verde River system (IMPR)	53	54	73	35	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	47	46	35	81	330,100 ac-ft
Elephant Butte and Caballo (FIPR)	31	32	48	26	2,453,000 ac-ft

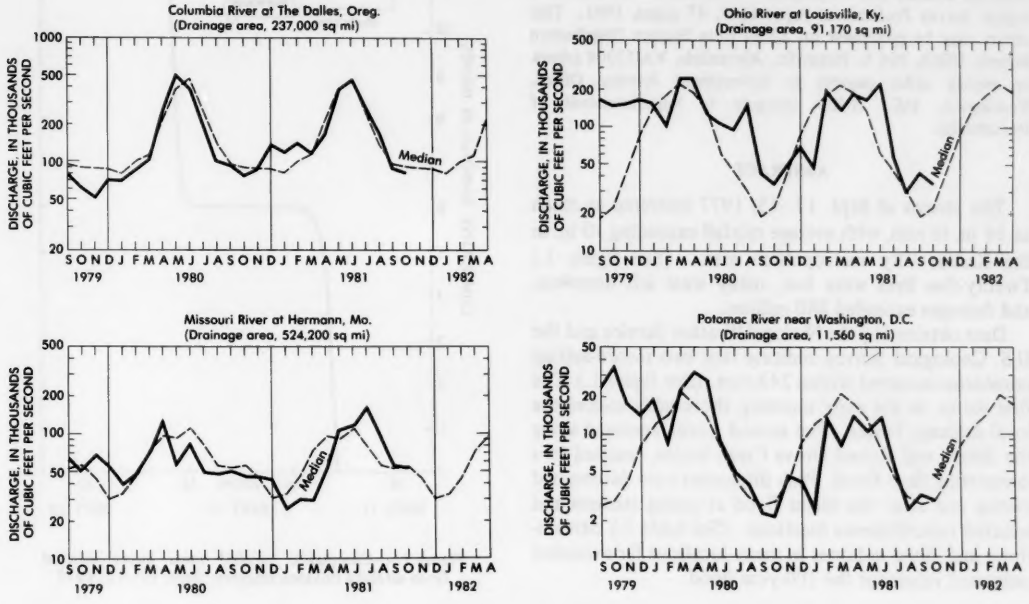
[a] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

FLOW OF LARGE RIVERS DURING OCTOBER 1981

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1975 (cfs)	October 1981					
				Monthly mean discharge (cfs)	Percent of median monthly discharge, 1951–80	Change in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1–0140	St. John River below Fish River at Fort Kent, Maine	5,690	9,549	18,233	379	+59	33,000	21,000	31
1–3185	Hudson River at Hadley, N.Y	1,664	2,853	4,540	315	+107	15,000	9,700	31
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,630	6,660	257	+104	18,000	11,600	31
1–4635	Delaware River at Trenton, N.J	6,780	11,630	4,525	92	+30	10,300	6,660	29
1–5705	Susquehanna River at Harrisburg, Pa	24,100	34,200	19,400	182	+153	128,300	82,900	31
1–6465	Potomac River near Washington, D.C	11,560	[1] 11,190	2,880	101	-9	16,200	10,500	30
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C	4,810	5,007	925	47	-58	1,700	1,100	31
2–1310	Pee Dee River at Peedee, S.C	8,830	9,657	3,140	68	-22	5,640	3,650	28
2–2260	Altamaha River at Doctortown, Ga	13,600	13,780	1,985	38	-25	1,870	1,210	24
2–3205	Suwannee River at Branford, Fla	7,880	6,970	2,000	44	-18	1,980	1,280	28
2–3580	Apalachicola River at Chattahoochee, Fla	17,200	22,330	6,800	62	-17	6,250	4,040	28
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala	15,400	22,570	1,842	47	-39	2,100	1,360	28
2–4895	Pearl River near Bogalusa, La	6,630	9,263	1,702	80	-14	2,880	1,860	31
3–0495	Allegheny River at Natrona, Pa	11,410	[1] 19,210	14,720	209	+25	12,900	8,340	26
3–0850	Monongahela River at Braddock, Pa	7,337	[1] 12,360	3,763	97	-59	3,050	1,970	26
3–1930	Kanawha River at Kanawha Falls, W.Va	8,367	12,530	4,643	77	+17	3,730	2,410	27
3–2345	Scioto River at Higby, Ohio	5,131	4,513	974	128	-15	2,490	1,610	30
3–2945	Ohio River at Louisville, Ky[2]	91,170	114,100	34,970	98	-20	32,400	20,900	26
3–3775	Wabash River at Mount Carmel, Ill	28,635	27,030	12,460	180	-42	14,400	9,300	27
3–4690	French Broad River below Douglas Dam, Tenn	4,543	[1] 6,794	1,691	48	+28	.....	.....	....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis[2]	6,150	4,185	4,139	186	+52	3,959	2,560	30
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y[3]	299,000	241,100	299,200	117	+1	298,000	193,000	31
050115	St. Maurice River at Grand Mere, Quebec	16,300	25,300	9,350	51	+49	17,200	11,100	31
5–0825	Red River of the North at Grand Forks, N. Dak	30,100	2,524	2,330	173	+34	2,100	1,360	31
5–1335	Rainy River at Manitou Rapids, Minn	19,400	12,950	9,200	85	+79	10,400	6,720	22
5–3300	Minnesota River near Jordan, Minn	16,200	3,412	2,260	215	-37	2,660	1,720	31
5–3310	Mississippi River at St. Paul, Minn	36,800	[1] 10,580	12,510	192	+30	15,000	9,690	31
5–3655	Chippewa River at Chippewa Falls, Wis	5,600	5,110	4,048	146	+157	2,000	1,300	31
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,613	8,053	148	+14	8,320	5,380	30
5–4465	Rock River near Joslin, Ill	9,551	5,852	9,130	278	+8	98,000	63,000	31
5–4745	Mississippi River at Keokuk, Iowa	119,000	62,570	73,000	207	+3	80,700	52,200	31
6–2145	Yellowstone River at Billings, Mont	11,796	6,986	3,738	89	+51	3,730	2,410	31
6–9345	Missouri River at Hermann, Mo	524,200	79,750	52,800	88	-5	57,900	37,400	27
7–2890	Mississippi River at Vicksburg, Miss[4]	1,140,500	573,600	275,600	95	-21	322,000	208,000	26
7–3310	Washita River near Durwood, Okla	7,202	1,414	4,710	908	+2,132	300	190	30
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex	9,730	724	387	140	+41	456	295	31
9–3150	Green River at Green River, Utah	40,600	6,366	3,750	131	+260	3,070	1,980	27
11–4255	Sacramento River at Verona, Calif	21,257	19,150	8,006	75	-31	7,350	4,750	28
13–2690	Snake River at Weiser, Idaho	69,200	18,170	13,360	92	+10	13,130	8,490	28
13–3170	Salmon River at White Bird, Idaho	13,550	11,290	4,931	99	+42	5,330	3,440	28
13–3425	Clearwater River at Spalding, Idaho	9,570	15,570	4,512	107	+120	4,650	3,010	29
14–1057	Columbia River at The Dalles, Oreg[5]	237,000	194,600	85,000	93	-8	.....	.....	....
14–1910	Willamette River at Salem, Oreg	7,280	23,810	8,380	115	+177	28,900	18,700	31
15–5155	Tanana River at Nenana, Alaska	25,600	23,850	16,000	103	-43	.....	.....	....
8MF005	Fraser River at Hope, British Columbia	83,800	96,400	51,900	71	-28	50,100	32,400	29

[1] Adjusted.
[2] Records furnished by Corps of Engineers.
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5] Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.
*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

HYDROGRAPHS OF FOUR LARGE RIVERS



WATER RESOURCES REVIEW

October 1981

Based on reports from the Canadian and U.S. Field offices; completed November 13, 1981

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EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for October based on 18 index stream-gaging stations in Canada and 164 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for October 1981 is compared with flow for October in the 30-year reference period 1951–80. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for October is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range.* In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the September flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of October. Water level in each key observation well is compared with average level for the end of October determined from the entire past record for that well or from a 30-year reference period, 1951–80. *Changes in ground-water levels,* unless described otherwise, are from the end of September to the end of October.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Subscriptions to the Review are free on application to the Water Resources Review, U.S. Geological Survey, MS 420, Reston, Virginia 22092.

FLOODS IN KANSAS CITY, MISSOURI AND KANSAS, SEPTEMBER 12–13, 1977

The abstract and illustrations below are from the report, *Floods in Kansas City, Missouri and Kansas, September 12–13, 1977*, by Leland D. Hauth and William J. Carswell, Jr., U.S. Geological Survey, and Edwin H. Chin, National Weather Service, National Oceanic and Atmospheric Administration: U.S. Geological Survey Professional Paper 1169, 47 pages, 1981. This report may be purchased for $3.50 from Eastern Distribution Branch, USGS, 604 S. Picket St., Alexandria, VA 22304 (check or money order payable to Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

ABSTRACT

The storms of Sept. 12–13, 1977 delivered as much as 16 in. of rain, with average rainfall exceeding 10 in. in the Kansas City metropolitan area. (See figure 1.) Twenty-five lives were lost, many were left homeless, and damages exceeded $80 million.

Data obtained by the National Weather Service and the U.S. Geological Survey indicate that two record-setting rainstorms occurred within 24 hours. (See figure 1.) The first storm, in the early morning, thoroughly soaked the local drainage basins. The second storm, centered along the Brush and Round Grove Creek basins, resulted in a devastating flash flood. Peak discharges were determined during and after this major flood at gaging stations and selected miscellaneous locations. (See table 1.) Streamflows and flood volumes in many locations far exceeded estimated values for the 100-year flood.

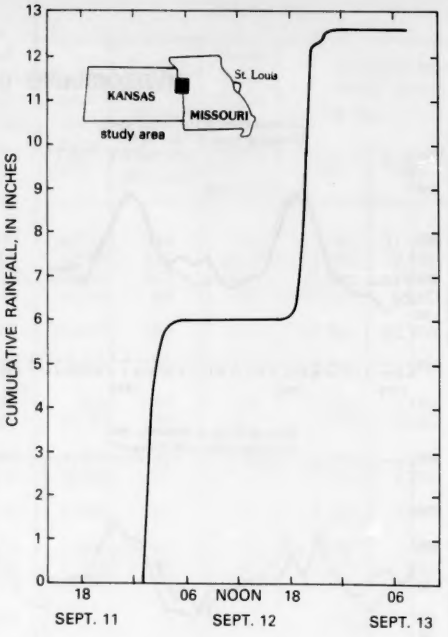

Figure 1.—Composite rainfall mass curve derived from satellite infrared imagery, Sept. 11–13, 1977

Table 1.—*Summary of peak stages and discharges for Kansas City area floods of Sept. 12–13, 1977*

Permanent station number	Stream and place of determination	Drainage area (mi²)	Period of record	Maximum previously known flood				Maximum flood of Sept. 12–13, 1977			
				Date	Gage height (ft)	Discharge (ft³/s)	Date	Gage height (ft)	Discharge (ft³/s)	Discharge [(ft³/s)/mi²]	Recurrence interval (years)
06892800	Turkey Creek at Merriam, Kans. (67th Street)	6.76	1974–	8-26-75	17.11	.....	9-12-77	21.65	5,300	784	100
06892940	Turkey Creek at Kansas City, Kans. (State Hwy. 10)	22,3	1974–	8-26-75	16.31	.....	9-12-77	25.2	11,700	552	>100
06893300	Indian Creek at Overland Park, Kans. (Marty Street)	26,6	1963–	7-15-76	[a]11.62	6,540	9-13-77	[b]872.38	8,820	332	>100
06893560	Brush Creek at Main St. at Kansas City, Mo.	14.8	1971–	.....	....	.....	9-12-77	23.24	17,600	1,243	>100
06893600	Rock Creek at Independence, Mo. (Northern Boulevard)	5.20	1968–	6-19-67	14.22	2,520	9-12-77	[b]841.93	7,760	1,492	>100
06893670	Shoal Creek at Claycomo, Mo. (U.S. Hwy. 69)	29.8	1976–	5-18-74	33.18	.....	9-12-77	[b]753.61	9,230	310	>100
06893710	Cates Branch near Liberty, Mo. (Sherril Drive)	1.95	.....	.....	....	.....	9-12-77	[b]765.87	2,480	1,272	>100
06893793	Little Blue River below Longview Road Damsite at Kansas City, Mo	50.7	1967–	6-27-69	11.19	.....	9-13-77	[b]819.67	18,100	367	>100
06894000	Little Blue River near Lake City, Mo. (Mo. Hwy. 78)	184	1949–	9-14-61	27.94	9,460	9-13-77	[b]742.45	17,000	95.1	>100
06894680	Sni-A-Bar Creek near Tarsney, Mo. (Colburn Road)	29.1	1971–	9-11-77	21.93	4,300	9-13-77	[b]811.67	15,700	540	>100

[a]At site 500 ft downstream.
[b]National Geodetic Vertical Datum (NGVD).

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